

REMARKS

Claims 1-14 and 16-20 are present in this application. Claims 1-12 have been withdrawn. Claim 13 is independent. Claim 15 has been canceled. Claim 20 is new.

Claim Rejections

Claims 13, 14, 16, 17, and 19 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Ema. Claims 15 and 18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Ema. Claim 13 has been amended to incorporate the subject matter of claim 15. Thus, the rejection based on 35 U.S.C. § 102(e) is moot. Applicant traverses the rejection under 35 U.S.C. § 103(a) based on the claims as amended.

Embodiments of the present invention are directed to a semiconductor device including a substrate and a gate over the substrate. A PMD layer is over the gate and the substrate. At least one via hole is not located over the gate and is not tapered. At least one via hole over the gate is also not tapered.

Embodiments of the present invention address problems that arise when an antireflective coating is provided directly on top of the PMD layer. In particular, in a conventional manufacturing process there are problems in production of via holes on a wafer, where resulting via holes are formed with different lengths. For example, the via hole over the gate may be shorter than the via hole over the source or drain. Also, although it is desirable to cut via holes straight, because a photoresist has a wide opening at the location where a via hole will be produced, the resulting via hole will be tapered. Subsequently, the diameter of the via hole

formed over the gate and the diameter of the via hole formed not over the gate are typically not equal (paragraph 0006).

Embodiments of the present invention solve the problems associated with the antireflective coating, by depositing a silicon layer as a mask material, as well as the antireflective coating over the PMD layer (paragraph 0026).

The Office Action alleges that via holes 122 and 60 teach the claimed “at least one via hole over the gate” and the “at least one via hole not over the gate,” respectively. The Office Action alleges that inter-layer insulating film 36 teaches the claimed PMD layer. With respect to claim 15, the Office Action alleges that inter-layer insulating film 150 in Fig. 55 teaches a PMD layer. Further with respect to claim 15, the Office Action alleges that Ema discloses a silicon layer 158 and an antireflective layer 156 deposited over the PMD layer 150, and etching a tapered hole 38,40 through the antireflective layer 156 and silicon layer 158 to form via holes. Applicant disagrees.

Ema discloses formation of through holes 38, 40 before the step associated with Fig. 52D. In particular, Ema discloses that a 100 nm-thick polycrystalline silicon film is deposited by CVD and etched vertically by RIE to form polycrystalline silicon sidewalls 160 on the sidewalls of the patterned polycrystalline silicon film 158. Thereafter, with the polycrystalline silicon films 158 as a mask, the inter-layer insulation film 150 is etched to form the through-holes opened on the drain diffused layers 26 and the through-holes 40 opened on the source diffused layers 24 (col. 56, lines 1-16; Figs. 52A-52D).

A subsequent step shows a polysilicon silicon film, a tungsten silicide film and a silicon nitride film are deposited by CVD and patterned by lithography and etching, then covered with silicon nitride film 156 (col. 56, lines 27-32). Therefore, Figure 55 shows that the polycrystalline silicon film and the tungsten silicide may be filled in the through holes 40 (col. 56, lines 39-41).

In other words, Ema discloses etching of the interlayer insulation film 150 to form through-holes 40 (Fig. 52D). The silicon nitride film 156, which is alleged as being the claimed antireflective layer, is applied in a subsequent step and consequently not disclosed as being for the purpose of forming through holes 38, 40. Therefore, Ema does not teach etching a tapered hole 38,40 through the antireflective layer 156 and silicon layer 158 to form via holes as alleged in the Office Action.

In addition, the layer 156 does not teach the claimed “antireflective layer,” as alleged in the Office Action. Layer 156 is disclosed as being a silicon nitride film 156 and is deposited over a tungsten silicide film (col. 56, lines 27-32). The Office Action alleges that the polycrystalline silicon film 158 teaches the claimed silicon layer over the alleged PMD layer 150. Thus, the silicon nitride film 156 is not located in a position to serve as an antireflective layer that suppresses unintended light reflection in photoresist and would not serve as an antireflective layer. In particular, Ema does not disclose that the silicon nitride film 156 constitutes an antireflective layer that is opaque.

For at least the above stated reasons, Applicant submits that Ema fails to teach or suggest at least the claimed “via holes that have been formed by depositing a silicon layer over the PMD

layer, depositing an antireflective layer over the PMD layer, etching a tapered hole through the antireflective layer and the silicon layer, and anisotropically etching the PMD layer.”

Applicant requests that the rejections be reconsidered and withdrawn.

New Claims

Claim 20 has been added. As claim 20 depends from claim 13, Applicant submits that at least for the reasons above for claim 13, new claim 20 is patentable as well.

Conclusion

In view of the above amendment, Applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert W. Downs (Reg. No. 48,222) at the telephone number of (703) 205-8000, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Application No. 10/688,873
Amendment dated March 14, 2006
Reply to Office Action of December 15, 2005

Docket No.: 0717-0523P

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Dated: March 14, 2006

Respectfully submitted,

RWD

By

Terrell C. Birch

Registration No.: 19,382

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road
Suite 100 East

P.O. Box 747

Falls Church, Virginia 22040-0747

(703) 205-8000

Attorney for Applicant